PARTNERSHIP FOR CLEAN INDOOR AIR

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PCIA Bulletin

This quarterly newsletter provides updates on the activities of the Partnership for Clean Indoor Air (PCIA) and its Partners to improve health, livelihood and quality of life by reducing exposure to indoor air pollution, primarily among women and children, from household energy use. More than **190** governments, public and private organizations, multilateral institutions, and others are working together to increase the use of affordable, reliable, clean, efficient, and safe home cooking and heating practices. *Visit www.pciaonline.org to join!*

This issue of the PCIA Bulletin is the third in a series dedicated to reporting on some of the tremendous accomplishments of PCIA Partners in specific regions of the world. The first issue in this series, Bulletin #14, presented some of the many important activities and achievements underway by PCIA Partners in Africa. Bulletin #15 focused on significant developments in Latin America and the Caribbean. This issue highlights just a few of the many impressive Partner activities and results to date in Asia.

In this issue you will find 9 spotlight and feature articles on Partner results throughout Asia, 3 recent Partner activity updates from the Philippines, India, and Korea, new research and upcoming events under "What's New" and our fact box highlighting PCIA Partners and events in the region. Please also check out our PCIA Partner Ashden Award winners announcement on page 4!

Partners in Asia are building their skills and programs through participation in workshops and trainings; producing, testing, and selling or otherwise disseminating stoves, solar cookers and retained heat cookers; publishing papers and manuals; exchanging information; scaling-up activities; and raising awareness on issues of indoor air pollution and health. If you know of other organizations in the region doing this important work, please introduce them to PCIA, encourage them to join, and please let us know so that we can help connect them to other local Partners and share the latest in resources and technical guidance and assistance.

As always, we welcome your feedback, including suggestions for future Bulletin themes, and urge you to share your own experiences through future issues.

Save the Date!

The 2009 PCIA Forum will be held in

Kampala, Uganda
March 24-28, 2009

More information about the Forum will be published in Bulletin #17, and on the PCIA website at www.pciaonline.org

In This Issue

PARTNER SPOTLIGHT Environment and Public Health Organization

Each quarter, the *PCIA Bulletin* highlights one or more Partners who are reducing women and children's exposure to indoor air pollution. This issue highlights the activities undertaken by ENPHO.

Assessment of Effectiveness of ICS in Nepal

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With more than 80 percent of the population depending on solid biomass fuel for cooking, indoor air pollution (IAP) is a major problem in Nepal. WHO estimates that 2.7 percent of Nepal's national burden of disease is attributable to solid fuel use and this causes 7500 deaths per year. In order to address this problem, various government and non-government organizations, private companies, and international agencies have initiated multiple programmes and introduced a variety of technologies to reduce IAP in Nepal. One of the most simple and popular technologies to reduce IAP in rural homes has been the improved cook stoves (ICS). The mud brick ICS is being promoted by the Energy Sector Assistance Programme (ESAP) of the Alternative Energy Promotion Centre (AEPC), as well as other agencies. So far more than 230,000 such stoves have been installed in the country and AEPC/ESAP plans to install 500,000 stoves in the second phase (2007-2012).

Realizing the need for effective monitoring and evaluation of the ICS, the Biomass Energy Programme of AEPC/ESAP recently conducted a study to assess the effectiveness of ICS in reducing indoor air pollution and improving health. The study titled **"Assessment of Effectiveness of Improved Cook Stoves (ICS) in Reducing Indoor Air Pollution (IAP) and Improving Health"** was assigned to Environment and Public Health Organization (ENPHO).

ENPHO is a service oriented scientific NGO established in 1990 that works to contribute to sustainable community development by combining research and action through integrated programs in the areas of environment and public health. ENPHO's mission is to develop and promote appropriate technologies to enable societies to become eco-friendly. ENPHO's laboratory, which has been accredited by the Nepal Bureau of Standards and Metrology, has produced various Field test kits and is involved in conducting regular monitoring of air quality and water quality. ENPHO primarily works in poor communities in urban and rural areas of Nepal at the household and community level, but has also worked at the national level and has provided trainings in India, Bangladesh and Laos on household water treatment.

As part of research for AEPC/ESAP, ENPHO carried out two major activities: (i) measurement of 24-hr mean concentrations of two principal indoor air parameters – particulate matter of size less than 2.5 micron ($PM_{2.5}$) and carbon monoxide (CO); and (ii) questionnaire survey and observation for both indoor air pollution and health impact assessment.

Traditional cookstove in Dolkha

Study design: The study followed the "Before-After" design; hence both pollution measurements and questionnaire-based surveys were conducted twice for each household: first before the installation of ICS or with traditional cook stoves (TCS), then again after the installation of ICS – two pot-hole mud brick stove. The study was designed in consultation with experts from the Centre for Entrepreneurship in International Health and Development (CEIHD) and through participation in the training "Measuring Change: Indoor Air Pollution and Household Energy Monitoring Asia Regional Workshop" organized by the Partnership for Clean Indoor Air (PCIA) at Hanoi from 7-11 August, 2007, which helped in

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finalizing the design. $PM_{2.5}$ was measured using UCB particle monitors, and CO was measured using HOBO CO loggers. All of the equipment was purchased new from CEIHD and calibrated at the Indoor Air Pollution Laboratory of University of California, Berkeley. Similarly, two different sets of questionnaires, one for IAP and the other for health impact assessment, were administered in both phases of study. This was followed with field observation. Data before installation of ICS was collected from 47 households in three different districts: Dolakha, representing high hills of Nepal; Ilam, representing mid-hills; and Dang, in the plains. Post-ICS installation data was collected from 36 of the same households. Parallel to this study, ENPHO, with support from Ajay Pilarsethi, a Fulbright Scholar, also conducted a cross-sectional study in Kavre District in the mid hills in 36 households with ICS and 36 households without ICS using the same equipment. The number of households for both the studies was determined based on statistical rules and sampling techniques designed by CEIHD for the Household Energy and Health Project (Edwards, et. al., 2007).

Improved cookstove and kitchen in Dand

Key findings: Some of the major findings of the study are as follows. The average 24-hr mean $PM_{2.5}$ concentration was 2.127 mg/m^3 in the before phase (kitchens with TCS) and 0.728 mg/m^3 the after phase (with ICS). The average 24-hr mean CO concentration was 22.174 ppm with TCS and 8.349 ppm with the ICS. The average percent changes in the IAP concentration between the TCS and ICS were therefore 65.73% for $PM_{2.5}$ and 62.34% for CO. The data shows that the pollution levels in houses that use TCS are very high and the ICS that is promoted in Nepal is quite successful in reducing IAP. However the fact that the pollution levels are still higher than WHO guideline values even after installation of ICS shows that there is a need for more improvement in areas such as ventilation and kitchen management.

By district, the highest and lowest 24-hr average mean $PM_{2.5}$ and CO concentrations were measured in Dolakha and Ilam respectively in both 'before' and 'after' measurements. In Dolakha, the measured mean concentrations of $PM_{2.5}$ were 3.374mg/m^3 with TCS and 1.429mg/m^3 with the ICS and for CO these were 38.557ppm with TCS and 17.172ppm with ICS. In Ilam, the mean $PM_{2.5}$ and CO were respectively 0.889mg/m^3 and 8.660ppm with the TCS; and 0.728mg/m^3 and 3.337ppm with the ICS. The large difference in pollution levels in the two districts both before and after the installation of the ICS shows that factors other than stove design, such as ventilation and cooking habits are also very important in determining IAP levels.

According to the main cooks in the households surveyed, remarkable improvements in the health condition of both the women and young children were observed following the installation of ICS. Major health outcomes included upper respiratory infections such as cough, phlegm, influenza, whistling/wheezing of the chest, headaches and eye irritation; the occurrence of these health outcomes were substantially reduced after ICS installation. Reported coughing events decreased from 55.6% to 16.7% after ICS installation in adults. In children, a similar change was reported from 96.2% to 46.2% after installation. However, as there was only a three month gap between the installation of the ICS and second phase of the assessment, the actual health impacts of ICS may not be very clear.

The concentration levels of IAP were found to be affected by a number of factors. These included ventilation conditions, fuel types and condition, users' behavior, geographical and climatic condition, and to some extent installation and use of the ICS. Some 69% of the households reported the occasional problem of smoke coming back into the kitchen.

The results of the cross-sectional study were very similar to the results from the before & after study. The cross sectional study done in 72 households found that the average $PM_{2.5}$ concentration in households with ICS was 66.4% less than the households with traditional stoves. Similarly the concentration of CO was 62.3 % less

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in households with ICS.

Conclusions: Overall, the study has found very high levels of indoor air pollution from burning of biomass fuels, particularly in houses with poor ventilation. However, the simple, low-cost and locally built mud brick ICS can reduce the pollution levels as indicated by concentration of $PM_{2.5}$ and CO by more than 60 percent. The ICS also results in significant health benefits as well as other benefits such as reduced firewood consumption, cleaner kitchens, and reduced time for cooking. Overall the ICS users are satisfied with their new stoves and feel that reduced smoke, improved health and reduced firewood consumption are the main benefits of the stoves. However, there is a need for more awareness programmes for scaling up ICS throughout the country. The findings of this study can be used as a tool for motivating people to install ICS. The study also shows that proper operation and maintenance of the ICS is essential for fully achieving its desired results and that other factors such as improved ventilation and kitchen management are equally important. AEPC/ESAP plans to follow up on this study by monitoring the same households one year after installation of the ICS. This will provide more valuable information on operation and maintenance of the ICS and its performance over a long period. For further details please visit www.enpho.org and/or www.aepcnepal.org.

ENPHO staff conducting interviews

Congratulations TIDE and Gaia on 2009 Ashden Award wins!

The title 'Energy Champion' and a prize of £40,000 was won by PCIA Partner **Technology Informatics Design Endeavour (TIDE)**, who is developing a range of stoves for large-scale cooking, and working with larger production centres in order to bring the stoves to more customers. To date 110,000 workers enjoy better conditions thanks to the 10,000 products they have supplied, saving around 43,000 tonnes of wood each year.

PCIA Partner **Gaia Association** in Ethiopia was also a 2008 award-winner, for their clean, safe ethanol stoves for refugee homes. The Gaia Association has provided ethanol-fuelled stoves to 1,780 refugee families in the Kebribeyah refugee camp who fled conflict in bordering Somalia, enabling clean, comfortable cooking and preventing wood use.

The call for entries for the 2009 Ashden Awards is now open. Expressions of interest are due by October 21, 2008. For more information on this year's winners, and requirements for 2009 submissions, please visit www.ashdenawards.org.

Request for information

The WHO, in collaboration with the University of Liverpool, is currently carrying out a systematic critical overview of activity, approach and impact of projects and programmes developing and disseminating interventions aimed at reducing domestic exposure to indoor air pollution. We are interested in hearing from any organization which has in the past 10 years:

1) Implemented household energy projects and programmes which aim to reduce indoor air pollution and, have carried out monitoring and evaluation that includes some form of IAP measurements and/or personal exposure monitoring.

2) All substantial programmes (dissemination of over 10,000 units) promoting clean fuels such as LPG and biogas. These programmes do not necessarily require to have evaluated IAP and/or exposure measurement to be eligible for this review, on the understanding that there must have been an assessment of the extent to which the clean fuel is being used for main cooking, heating and other tasks previously carried out with solid fuels.

Please send any information as soon as possible to Kirstie Jagoe at kjagoe@liverpool.ac.uk.

☼ FEATURE ARTICLES

Appropriate Rural Technology Institute, Pune, India
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Appropriate Rural Technology Institute is a not for profit organization in India which has been working in the field of sustainable rural technologies for the past 20 years.

The indoor air pollution monitoring (IAP) team of ARTI headed by Dr. Karabi Dutta has over 8 years of experience in project development, planning, resource assessment, and community level decision making in monitoring and evaluation of IAP and health. She and her team members have worked extensively in rural India and also in other Asian countries. The team also provides training to NGOs and private organizations. In the last 3 years we have been engaged by many organizations for monitoring indoor air pollution and evaluating improved cook stoves. A brief summary of our activities along with the challenges that we faced is discussed below.

In a USAID funded project to reduce exposure to IAP through household energy and behavioral change in Bangladesh, Winrock International subcontracted ARTI in 2006-2007 to test improved and traditional biomass cook stoves, to conduct a 'before and after' indoor air pollution survey in the rural households of Saidpur, and to provide recommendations for the best improved stove to be introduced in that area. The project's main objectives were to increase awareness and behavior change about IAP and to promote and develop a commercial market for ICS, including training for entrepreneurs. The project promoted three stove models, which were all tested for efficiency and emissions, and validated by the target households. These stoves were the BCSIR 2 pot, BCSIR 1 pot portable, and Grihalaxmi. ARTI also provided training in improved stove construction, use and maintenance to entrepreneurs, mostly women. The stoves that were promoted under this project were selected through controlled cooking tests (CCT), 48-hour monitoring of particulate matter (PM 2.5) and carbon monoxide (CO), water boiling tests, and kitchen performance tests (KPT). The 48-hr monitoring took place for ICS which had been in use for at least one month.

Measurements of carbon monoxide (CO) and fine particulate matter ($PM_{2.5}$) were conducted for a 48-hour period in kitchens a month after the installation of the improved stoves, the 48-hr mean CO concentration was reduced, on average, by 99% for the BCSIR 2 pot fixed model with chimney, 98% for the BCSIR 1 pot portable model and 65.2% for the VERC Grihalaxmi. Similarly, the 48-hr mean $PM_{2.5}$ concentration was reduced, on average, by 71% for the BCSIR 2 pot fixed model with chimney, 84.4% for the BCSIR 1 pot portable model and 39% for the VERC Grihalaxmi. For performance monitoring there was a strong focus on identifying stoves which were suitable for the cooking practices of the target community.

Woman cooking a meal in a improved stove with chimney

There were some challenges in this project. The project team discovered that households tended to change stove dimensions during maintenance and, in some cases, households made significant changes to stove dimension. In some cases the women themselves installed the stove without the help of the entrepreneur to save the cost of installation. This led to design and dimension problems. Another recurring problem was the lack of maintenance of chimneys. In future projects ARTI will provide users with more detailed training on the use and maintenance of stoves for their optimum performance.

Right Track is an NGO in Kolkata, India working in both rural and urban areas to improve the living conditions of the poorer sections of the society Their objective is to provide improvement in quality of air, drinking water, and sanitation using better technologies in an integrated project. Understanding that low cost and highly efficient

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cook stoves would have a strong role in bringing about improvements in indoor air quality for these communities, they engaged ARTI's services in 2006 to support this work. One of ARTI's strong recommendations was to involve local youth for production of low cost and improved cook stoves using locally available materials which would bring down the cost of the stoves. The stove models were tested and selected using a method to that used in the project mentioned above. The stove performance test result and field survey showed that the improved Grihalaxmi stove, a cement single pot stove with 2 grates, is ideally suited for the tree bark used as fuel by people in some of the urban slums.

Woman cooking a meal in an improved portable metal Oorja stove developed by BP

It was an interesting study since it was our first experience working in urban slums. There were a lot of challenges and opportunities for learning. Drop out of households between sampling rounds due to high population migration rates was common, requiring care in choosing sample sizes. Multiple fuel and stove use in some areas complicated the collection and interpretation of changes in fuel use and air pollution. In such areas, future studies may have to be done for more careful stratification of households to obtain the statistical power to make judgments. Chimney stoves, although ideal for improving IAQ, cannot be used in any of these 5 study areas because the roofing materials are flammable and even a small splinter or spark could lead to a major fire. In addition, the height of the households (not more than 5-5.5 feet) would put installed chimneys at 6-6.5 feet, almost at the nose level of men and women. It would also create a smoke blanket over the houses at a relatively low level, which is dangerous and very unhealthy. Faced with these challenges the recommendations were to redesign the kitchen architecture for better ventilation, upgrade the fuel type used by the slum population by spreading awareness regarding the harmful health effects of indoor air pollutants and finally, as a short-term solution, introduce Grihalaxmi stoves without chimneys. The project is ongoing and we will be conducting a cost benefit analysis of household energy in the slums. A detailed report of this study is available at: http://www.hedon.info/goto.php/CleanAirSIG:IAPInSlumsKolkataIndia.

In 2007, ARTI completed a two year project sponsored by the Department of Science and Technology, Govt. of India entitled,' Establishing norms for kitchen architecture and cooking devices for pollution free cooking in rural Maharashtra'. The objective of the project was to measure the indoor air quality in rural households in three seasons (summer, monsoon and winter), using different cooking devices to prepare a baseline data for Maharashtra. ARTI recorded the air movement rates and architectural features of the kitchen that facilitate or hinder air movements, and established correlations between the levels of pollution in the kitchen air with the degree of ventilation, type of fuel, and type of cook stove in the kitchen. Based on the data collected ARTI had planned to design models of ideal kitchens for each of the 5 regions of Maharashtra that would reduce indoor air pollution with due consideration to specific regional requirements. The results of the study showed, however, that overall the rural kitchens have no standard air flow rate and cannot be categorized into region. Instead, ARTI prepared a list of design parameters to be taken into account while designing a rural kitchen in India. For example, ventilation is reasonably good in kitchens with eave spaces between the wall and roof, and in those with thatched roofs.

At present the three staff members of ARTI have been contracted by Philips Electronics to test the Philips portable woodstove models. ARTI is testing the stoves in the laboratory as well as in the field for emission and efficiency. The stoves are also tested through controlled cooking tests (CCT) and kitchen performance tests (KPT) in the field. We are also conducting some home placement tests to get consumer feedback. This work is unique in several ways. Most stove projects in India to date were either initiated by NGO's or research institutions or by national governments with plans for subsidy; until now

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private organizations were rarely involved in the stove business as it was not thought to be a profitable enterprise. In addition, stoves in many other projects are region-specific products based on the cooking needs and patterns of the target consumers. The Philips woodstove is not region specific, which adds another dimension of challenge. This may be the first time that a company developing consumer durables is developing a product for the rural market. Results are not yet available for public dissemination. For more information on ARTI please visit http://www.arti-india.org.

Indoor Air Pollution Assessment in Urban Slum and Rural Households in Bangladesh, Our Six Years of Experience

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Indoor air pollution (IAP) is a major environmental health issue in Bangladesh due largely to the use of solid fuels in inefficient cook stoves in poorly ventilated households. About 97% of 140 million population depend on solid fuels for cooking and household energy. Women and children under age 5 in urban slum and rural areas in Bangladesh suffer greatly from acute respiratory infections (ARI) due to exposure to smoke and copious amount of particulate matter ($PM_{2.5}$), carbon monoxide (CO) and volatile organic compounds (VOC) from the burning of solid fuels. The Exonics Technology Center (Dhaka, Bangladesh) in collaboration with Wagner College (New York, USA) have been carrying out IAP monitoring in slum households in Dhaka city (Karwan Bazar, Beri Badh areas), municipalities of Saidpur, Parbatipur (located in northern Bangladesh approximately 200 kilometers from the capital Dhaka) and rural areas of Dhamrai, Manikganj, Gajipur (50 kilometers north from Dhaka) for the last six years. In urban slum and rural households typical fuels in cook stoves include wood, household garbage, coconut husks, rice husks, bamboo, cow dung, paper and fabric. Around Dhaka city there are over 250 tanneries and in many slum households near these tanneries, discarded hide is also used as fuel in cook stoves.

Our IAP monitoring in slum dwellings in two areas of Dhaka city in 2002-2003 found total suspended particulate matter (SPM: $PM_{2.5}$ and PM_{10}) ranging from 5250±280 µg/m^3 air to 14360 ±480 µg/m^3 air. During 2005-2006, Wagner College and the Exonics Technology Center in collaboration with Winrock International (Virginia, USA) and Concern Bangladesh carried out IAP monitoring in 68 urban slum households in Saidpur and Parbatipur, two municipalities in Bangladesh. These were a subset of a total of 1200 households participating in an intervention to reduce exposure to IAP.

IAP monitoring in slum households in Bangladesh

Concern Bangladesh is a local NGO in Saidpur and has been working on sanitation and hygiene for vast populations in northern Bangladesh for many years. As the local partner, Concern Bangladesh helped in selecting the households in the study area in Saidpur, conducted health impact survey and provided vital local support for our project. In these slum households, the mean level of $PM_{2.5}$ (551±370 mg/m^3 air) was almost 9-10 times higher than the USEPA permissible level of 65 mg/m^3 air during cooking period[1]. During the same period CO levels were at least 3-4 times the USEPA permissible level of 9 ppm (8 h average). Even during the non-cooking period, the mean $PM_{2.5}$ level (129±105 mg/m^3 air) in the same group of households was at least 3 times the USEPA permissible level. During the cooking period, the 12 hour mean $PM_{2.5}$ varied from 220 to 3080 mg/m^3 air. We believe the inter-household variation is affected by household building materials, type of fuel, location and ventilation of cooking area. In a recent study in 2004 involving 598 households in 6 urban and rural areas of

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Bangladesh, the indoor PM_{10} levels in urban households were reported to vary from 202 to 410 mg/m^3 and in rural households PM_{10} was reported to vary from 68 to 4,864 mg/m^3 of air[2].

A number of toxic trace elements were measured in indoor air in our study. Mean±SD (ng/m^3) for a few of the trace elements measured in 40 select slum households in Saidpur (2007) were: Pb 432 ± 135 ng/m^3; Cd 29 ± 18 ng/m^3; As 510 ± 257 ng/m^3; Cr 607 ± 221ng/m^3.

Using an onsite sampling technique based on solid phase micro-extraction and gas chromatography, we detected multiple VOCs in rural kitchens that are a potential health hazard[3]. Major VOCs detected in these poorly ventilated kitchens include benzene 803 $\mu g/m^3$ air, toluene 370 $\mu g/m^3$, ethylbenzene 566 $\mu g/m^3$, n-propylbenzene 600 $\mu g/m^3$, heptane 136 $\mu g/m^3$ along with other hydrocarbons. In the same rural neighborhood, mean total VOC level in a moderately ventilated kitchen was 873±135 mg/m^3 air compared to 4622±200 mg/m^3 air in poorly ventilated kitchens[3]. These levels are several fold higher than the USEPA maximum permissible standard of <200 mg/m^3 for TVOC (total VOC) in indoor air.

Beginning January 2008, Exonics Technology Center (ETC) (Dhaka, Bangladesh) and Wagner College (New York, USA) initiated a project to improve indoor air quality in Saidpur slum households, including improved cook stoves (ICS). A number of local ICS models were previously tested by the Appropriate Rural Technology Institute in 2006 with a view to promote ICS in Saidpur slum area (see previous ARTI article for more details). We chose the BCSIR 2-pot cookstove with chimney made by local entrepreneurs previously trained by ARTI because this model was found to be the best performing of 3 models of ICS tested by the ARTI with regard to fuel efficiency and reduction of IAP[4]. Because the households are so congested and cross diffusion of smoke is a serious issue, we have decided to install the ICS and train users in all 1200 households phase by phase in our work area. We are installing it at no cost to the households.

There has been a significant reduction of smoke in the households covered so far under our ICS program. Based on the visible improvement of indoor air quality, many dwellers came forward and asked for ICS to be installed in their households. Beginning June 2008 we are conducting post-installation monitoring of $PM_{2.5}$ and CO in a select group of 40 households to confirm improvements in IAP. We are also conducting a health survey and monitoring fuel usage in these households. The IAP data collection and health impact survey will take place every six months through the end of 2009. In addition, three field monitors have been employed from the locality; they will be making weekly visits to all households to ensure proper use and maintenance of the stoves. The field monitors will work closely with the primary cook and maintain weekly logs of their visits so that appropriate follow up can be made with the users.

The following results were achieved and additional installation of stoves are planned:
* installed 100 locally manufactured low cost improved stoves in slum households in Saidpur
* promoted local entrepreneurship to commercialize stoves
* achieved significant improvement in indoor air quality in the above households
* created significant awareness among slum dwellers regarding ill effects of IAP
* installation of 100 additional improved stoves is scheduled in next two months
* eventual aim is to bring 1200 households under the improved stove program.

Acknowledgements: The projects were supported by grants from the USAID and Fox Fund from Wagner College, USA.

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New Funding Awarded for Three Scale-up Projects in Asia

The U.S. Environmental Protection Agency (USEPA) recently competed and awarded cooperative agreements totaling approximately $1.3 million to six highly capable household energy and health programs in Africa, Asia and South America that have successfully produced commercially viable cooking and/or heating technologies. These projects will significantly increase the availability and use of affordable, reliable, clean, efficient and safe home cooking practices through the scaling up of already sustainable manufacturing and delivery systems.

All awardees successfully met program requirements by demonstrating that their proposed technology to be scaled up 1) reduces concentrations of particulate matter and carbon monoxide by a minimum of 50%, and reduces fuel use by a minimum of 30% over current local practices; 2) meets the needs of the target population (e.g., is affordable, reliable, clean, efficient, and safe); 3) provides a social benefit (e.g., has a positive impact on health, local employment and income generation, environment, and/or family finances); and 4) utilizes a financially sustainable business model.

Three of the scale-up projects are located in Asia and are described below. Descriptions of the Africa and Latin American projects can be found in PCIA Bulletin #14 and #15, respectively.

Aga Khan Foundation Brings Energy Efficient and Home Improvement Products to Northern Pakistan to Reduce Fuel Costs and Smoke-related Diseases

With USEPA funding, the Aga Khan Foundation aims to reach one million people living in 120,000 households in high altitude regions of northern Pakistan with a minimum goal of 50% reduction in fuel-wood purchase costs and 50% reduction in smoke-related diseases incidences. The Northern Areas and Chitral of Pakistan are two of the most remote and economically disadvantaged regions of Pakistan, with approximately 85% of households in the regions using biomass as fuel for cooking and heating. This program will be implemented by the Aga Khan Planning and Building Service of Pakistan (AKPBSP).

The program will promote Energy Efficient and Home Improvement (EE&HI) products that are affordable, commercially viable, replicable, and can significantly impact households' economic and environmental well-being. More than 60 EE&HI products have been developed and tested given significant community feedback. The variety of products available help in improving: energy efficiency, indoor space management, seismic resistance of construction, house planning and designs. These include Fuel Efficient Stoves, Water Warming Facilities (Geysers), Solar Cookers, Wall, Roof and Floor Insulations, Utensil Cabinets, Bedding Racks, Kitchen Worktop, Wire Mesh Reinforcement Techniques, Light Weight Roofs and Roof Treatment Techniques.

Woman in Chitral using BACIP stove and the water warming facility-Geyser

The program will attempt to further build and strengthen a market-based supply chain in Northern Pakistan to support and enhance the creations of private enterprise linked to producing, distributing, and selling EE&HI products. In addition, this project will establish a business enterprise and improve the efficiency of the value chain to support entrepreneurs, artisans and others involved in marketing, distributing, and selling EE&HI products on a market-driven and commercially viable basis. This program will use a variety of information, education and communication tools to disseminate information about the dangers of indoor air pollutions and the socio-economic and health benefits of EE&HI technologies. By the end of the two year grant, Aga Khan intends to sell 5,500 improved cooking stoves in addition to other EE&HI products.

Ms. Patricia Scheid, Director, Programs and Partnerships reports that "Aga Khan Foundation USA (AKF USA) is looking forward to building a relationship with another U.S. government agency, and particularly one such as the EPA

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which has such a breadth of experience to share. AKF USA's sister agency in the field, Aga Khan Planning and Building Services (AKPBS), is also looking forward to enhancing international involvement in its programming and learning from EPA's knowledge base. More specifically, this grant provides AKPBS with a great opportunity to make the organization more effective and responsive, and to contribute to improving the environment, human health and creating a more sustainable world."

"AKF USA is confident that this agreement works well with its objective og finding innovative solutions to pressing challenges in the developing world. Through this cooperative agreement, AKF USA's sister agency in Pakistan (AKPBS) will be able to engage in activities that it has wanted to for some time-such as improving the marketing and distribution of energy efficient products, testing developed products and undertaking extensive impact studies-but has had difficulty in finding resources for. Through this agreement, the hope is that there will be an improvement in AKPBS's Building and Construction Improvement Program (BACIP) sustainability, wider dissemination of its products and increased socio-economic and environmental impact."

National Programme Manager, Mr. Faisal Farooq Khan states promoting energy efficient smoke free stoves and other such products is a critical element in providing a decent home to the poor and is intimately tied to AKPBS's inspiration that "the visual, physical and emotional impact of a decent home can light the spirit of human endeavor. A proper home can provide the bridge across that terrible gulf between utter poverty and the possibility of a better future". To AKPBS, improving household energy and health is poverty alleviation at its core, particularly given the context the agency works in."

The China Association of Rural Energy Industry Expands Biomass Stove Sales into Western China

Under a cooperative agreement with the USEPA, in partnership with the Chinese Government and Center for Entrepreneurship in International Health and Development (CEIHD) and the Berkeley Air Monitoring Group, and with co-funding from the Wuppertal Institute's WIsions program, the China Association of Rural Energy Industry (CAREI) is promoting and expanding the latest and most innovative biomass stoves into Western China. In the poorer markets of Western China, there is currently no supply of these advanced cooking technologies. The top winners from a 2007 Chinese National Stove competition sponsored by the Shell Foundation of high-efficiency and low-emission stove will be mass produced and sold to the agricultural and herding people of Western China. Stove designs will have the potential to be modified to accommodate for local fuel and cooking needs for each customer segment as needed.

In the two year grant cycle, 20,000 stoves will be sold, improving indoor air quality and fuel savings for 60,000 to 100,000 people. This program will utilize a combined market awareness approach to make stoves available to poor farmers in remote areas. In addition, Chinese Ministry of Agricultural and local Rural Energy Offices will provide subsidies to farmers that purchase renewable energy products. This project will also promote social and health benefits, through educating children on the health effects, distributing 10,000 posters and 20,000 brochures on optimal stove usage and kitchen management. CEIHD will provide technical assistance in conducting monitoring and evaluation of these stoves to measure quality and efficacy in reducing IAP.

Tibetan woman use the CAREI-promoted biomass stove

Chen Xiaofu, Deputy Director of Efficient Stoves Division, CAREI, Project Manager, reports that "There are 290 million households in China and about 50% of the living fuel is biomass in most areas. The biomass stove is one of the most suitable technologies to promote to farmers. Also, there are many technologies that can be applied to improve living conditions for farmers, such as biogas digester, biomass pyrolysis centralized gasification, a new type of coal stoves, and solar energy."

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"With the support from USEPA, CAREI can realize our thoughts and ideas. We have many resources and networks in the field of rural energy industry, so the PCIA project acts as a bridge to connect us together to promote biomass stove scale-up. The grant also demonstrates to Chinese people that many foreign developed country friends are paying more attention and giving great help to improve their living conditions, which will increase the friendship between China and the U.S."

"What excites us most about working in the household energy and health field is that more and more people in poor rural areas can use high-efficiency and low emission biomass stoves which replace the traditional ones, and thereby result in clear indoor air quality and make people, especially women and children, more healthy."

Practical Action Uses Innovative Financing Mechanisms to Develop a Sustainable Stove or Smoke Hoods Enterprises in Nepal

Through this project with USEPA, Practical Action – Nepal will empower 6000 rural people with knowledge about the dangers of indoor air pollution from cooking fires so that they can identify ways of reducing their exposures through smoke-reduction strategies and technologies. Using innovative financing mechanisms, the project will result in the installation of smoke hoods in 1000 households and a development of sustainable smoke hood enterprises involving 10 local entrepreneurs/suppliers in manufacturing, installation, business development and management of smoke hoods.

Practical Action will establish a Revolving Fund to be managed by microfinance institutions and other financial intermediaries to provide loans for acquiring smoke hoods as well as other income generating activities for interested households. The seed money to form the revolving fund will be 50% of total cost requirements. In addition, Practical Action will form and strengthen 40 community groups and link with local micro-finance institutions or other financial intermediaries for credit facilities to buying smoke hoods and other income generating activities. Over the life of the project, efforts will be made to increase investment by 10% annually by Districts Development Committees of respective districts for the improvement of indoor air quality and cleaner household energy.

Another critical element of this project will be to develop quality control mechanisms to ensure supply of high quality smoke hoods and after sales services. The smoke hoods will reduce people's exposure to particulate matter (PM) and carbon monoxide (CO) by 65%, and reduced fuel wood consumption by 30% over current use. Community members will be encouraged to install the smoke hoods and at the same time to improve their stoves and insulate their kitchen walls. In addition, community members will be exposed to behavioral change activities such as fuel drying, reducing personal exposure, reducing the time spent for cooking, use of pot lids for cooking efficiency, and better hygiene.

Local manufacturers making smoke hoods

Ms. Jun Hada, Team Leader, Access to InfrastructureServices Programme, reports "We are taking this collaboration with EPA as recognition of our contribution to fighting IAP. We are taking it as an opportunity to strengthen our network with many other PCIA partners and to learn from them to enhance our own knowledge. Practical Action in Nepal has made a target to save 21,000 women and children from adverse health impact of indoor smoke during our Strategic Plan period from 2007-12. This EPA Cooperative Agreement will help us initiate our plan forward in 2 new districts. In addition, with this we also hope that we will open up opportunities to raise more funds from the US government and other potential donors to reach our strategic target."

"In Nepal, 85 percent of households are still dependent on solid biomass fuels for cooking energy. Indoor air pollution has been a major environmental health issue. Our research findings show that the IAP levels are excessively (more than 15 times) higher than the recommended safe level in rural Nepal. According to 2007 data

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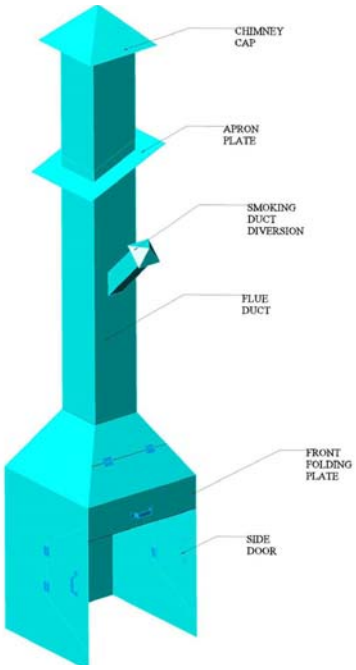
published by WHO, about 7,500 people died from illness resulting from IAP in Nepal in 2002. Recently, our cost-benefit analysis suggested that it is viable to invest in smoke hoods in the context of saving health cost and fuels.

Though there are other agencies working on other environmental health issues, very few organizations are working in this area. The multifaceted impacts, including on health, income, environment, and drudgery, have not been given due attention by the government. They has been neglected in the national development agenda. Recently we have started to advocate from rights-based perspectives as well. Together we need to continue our concentrated effort combining all the aspects working with even more stakeholders. Our past experience suggests that in the household energy and health arena, things like modest support on social awareness raising can bring a significant change. The way we are addressing this issue collectively is more exciting."



Schematic of improved smoke hood

Developing Markets for ICS in Rural Nepal

Subarna Prasad Kapali, Consultant Socio-economist, Centre for Rural Technology, Nepal, subarna@crtnepal.org

Market potential: Nepal is heavily dependent upon traditional sources of energy (85%) such as fuelwood, agri-residue and dungcake. A majority of energy (88%) is used by the household sector for cooking. Traditionally, rural people in Nepal have used mud stoves or three-stone open fires. The traditional stoves are good enough to cook Nepali foods which include rice, lentils, vegetables, millet porridge and *roti*. However, these stoves are inefficient (10%) and cause high levels of indoor air pollution. With about 85% of Nepal's 27 million population living in rural areas there is therefore a huge potential market for improved cook stoves (ICS) in Nepal.

Market creation: The history of ICS promotion in Nepal dates back to early 1950s. Since then a number of government and non-government organisations have launched various promotional programmes intervening on both the demand side and supply side. The government launched a massive programme on ICS during 1975-6. Likewise, promotional programmes were launched in 1980s and 1990s as well. In almost all programmes, raising awareness has been the main strategy for demand creation for ICS.

Many of these programmes have focused on capacity building and R&D. The current ICS design now being widely promoted, called the *Tamang* stove, was developed in 1990 by Research Centre for Applied Science and Technology, Tribhuvan University.

Since its establishment in 1989, Centre for Rural Technology, Nepal (CRT/N) has been a key player in the promotion of ICS through implementation of promotion programmes supported by various international organisations. All these efforts have contributed in the creation of a market for ICS in rural Nepal.

Market expansion: A rapid expansion of the market began when Alternative Energy Promotion Centre (AEPC)/Government of Nepal launched a National ICS Programme (NICSP) under the broad framework of Energy Sector Assistance Programme in 1999. Being a lead organization in the sector, CRT/N was assigned to be the main implementing agency of the programme. During the first four years of the programme, CRT/N promoted the successful adoption of more than 130,000 ICS across the country.

The NICSP-promoted household stoves are constructed on site by trained promoters, usually women belonging to poorer segments of the

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community. The users pay the promoters in cash for their services. The marketing effort made by the promoters and quality of service they render have been crucial factors in the expansion of the ICS market in rural areas.

Involvement of local organisations has been another key factor for growth of the ICS market. CRT/N as the main implementer of the programme has assisted in capacity building of a number of local partner organisations that coordinate and monitor community level activities of NICSP. In order to give further thrust to this factor, CRT/N has also been imparting knowledge and skills to upgrade overall capability of local NGOs through the National ICS Network of Nepal. The Network is coordinated by CRT/N and is supported by the Asia Regional Cooktove Programme (ARECOP).

Well trained promoters are the best agents for promotion of ICS in rural areas.

Product diversification: So far, the NICSP has been promoting only one design of stove (with some variations) which is suitable for the mid-hills region only. Therefore, product diversification is necessary for expansion of the ICS market in high hill and the *Terai* (southern plain belt) areas. CRT/N has contributed in this direction by conducting an adaptive research on various designs of ICS; some designs have been found suitable for promotion in high hill and the *Terai* area.

Currently, CRT/N has been implementing a carbon project on ICS in Chitwan district in the *Terai*. A new concept incorporating a ceramic combustion chamber has been introduced in the stove design. The success of the project will demonstrate the feasibility of ICS as a carbon project and hopefully also open the door for promoting ICS at massive scale in the *Terai*.

Penetration into the institutional sector, for example for schools, teashops, and army/police barracks is another dimension of market expansion under consideration. In this regard, CRT/N recently conducted a laboratory testing of institutional ICS with support from the International Committee of Red Cross (ICRC) to be installed at jails. CRT/N has also installed institutional ICS at some Maoist People's Liberation Army cantonments.

China's Rural Renewable Energy Standardization

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Since the 1990s renewable energy has developed rapidly in rural China. By 2003, many rural renewable energy technologies and models have been adopted and applied in the vast rural areas: 21.74 million household biogas digesters, 0.13 million biogas digesters for municipal sanitary sewage purification, 17,774 large and medium scale biogas plants on husbandry farms, 143 million improved stoves, 39.41 million m^2 solar water heaters, 13.95 million m^2 passive solar houses, 602 biomass gasification plants and 76,061 micro-hydro power plants.

To a great degree, the rapid development of rural renewable energy has benefited from the great advance of standardization work. The formation of a complete rural renewable energy standard network has not only hastened the transformation of technical achievements, but also promoted the extension and application of new technologies and products.

According to Standardization Law of the People's Republic of China, the Ministry of Agriculture (MOA) is in charge of the administration of rural renewable energy standardization throughout the country. The formulation, implementation and supervision of rural renewable energy standards have been supported by the complete management, extension and technical supervision network that MOA has established. To date, MOA's Standardization Committee has established

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11 sub-committees and another 6 sub-committees are planned. MOA has planned to establish 280 Products and Appliances Quality Supervision and Testing Centers, including a Biogas Products and Appliances Quality Supervision and Testing Center, a Micro Hydraulic Generator Center and an Energy Efficiency Center. In 2003, the proposal to establish a Fuel wood and Coal Saving Products and Appliances Quality Supervision and Testing Center in Zhengzhou city, Henan province and Quality Test Center for Firewood and Coal Saving Product of MOA in Beijing city was formally approved.

Although rural renewable energy standardization has started only recently, great progress has been made. Up to now, 68 standards have been formulated, including 25 biogas standards, 4 biomass standards, 13 solar energy standards, 9 energy efficiency standards, 9 micro hydro standards, 2 small wind power standards and 6 new fuel standards.

1) Biogas standards: For the past 20 years, great efforts have been made to promote biogas standardization. The current biogas standards have mainly covered biogas digester drawingsdesigns, rules for construction, check review and acceptanceapproval, and biogas cookers and related products, including integrated utilization of biogas technologies.

2) Biomass standards: MOA has formulated 3 standards covering technical requirements for gasifiers, testing methods, construction rules and stove standards. Two standards are being formulated for briquettes and pellets and production equipment. Another 2 two standards on performance testing methods shall will also be formulated.

3) Solar energy standards: Solar heat utilization and household PV systems are the major solar energy utilization technologies adopted in rural China. Currently, 13 national and trade standards have been enacted by MOA for solar heat utilization, covering solar heat utilization terms, mechanical testing and technical requirements for some components and materials, technical requirements for products and systems, testing methods, design, technical norms on installation and acceptance check.

4) Small wind power standards: Small wind power system in China refers to the off-grid wind power system whose per unit power is not more than 10 KW. For the past 20 years, national and trade standards have been formulated. Most of these standards apply to off-grid small power systems, covering small wind power terms, types, basic parameters, rules to organize model numbers, technical specifications, safety requirements, quality rating and testing methods.

5) Micro hydropower standards: Micro hydropower system refers to the system whose per unit set's power is not more than 100 KW. It can be independent household system, or systems gridded to village or township power network. Since 1993, MOA has formulated 9 national standards, including technical specifications on micro hydro power generating facilities, testing methods for micro hydro power generating facilities, technical requirements on the installation, quality rating of micro hydropower generating facilities and on safety operation, etc.

6) Geothermal energy standards: There are only two geothermal energy standards in China, one is GB 11615-89, Geologic prospecting planning on geothermal energy resource, and the other is DZ 40-85, Methods for Geothermal resource evaluation, which were issued by Ministry of Geology and Minerals. Currently, geothermal energy plays a minor role in agricultural production and rural living. MOA has not formulated any standard on geothermal energy. Instead, standards formulated by other agencies have been directly adopted by MOA.

7) New liquid fuel standards: This term refers to the alcohol group, ether group and light hydrocarbon fuels. Since 1994, the new liquid fuel industry has been put under the administration of MOA. MOA has not only strengthened industrial guidance and supervision, but also organized enterprises and R&D institutes to conduct standard formulation and implementation. Since the end of 2004, 6 standards have been formulated to regulate alcohol group and light hydrocarbon fuel and cooking utensils, covering technical requirements, testing methods, storage vessels, transportation and sampling rules Among the 6 standards, 1 is a national standard and the other 5 are trade standards.

8) Energy efficiency standards: The term refers to fuel wood and coal saving stoves, cookers, adobe beds and kilns. As one of the earliest developed areas in rural renewable energy industry, energy

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efficiency standardization began in early 1980s and it had focused on civil coal furnaces, fuel wood stoves and energy efficient adobe beds, which had been essential to rural daily life. With the changing of rural live styles, in addition to cooking demands, farmers' demand for heating has increased. Since mid 1990s, MOA has formulated product and testing method standards on household cooking and hot-water heating coal furnaces.

Impacts of Alternative Energy Program on Indoor Air Quality in Northwest Yunnan, China

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PCIA's goal of improving health, livelihood and quality of life by reducing firewood consumption and exposure to indoor air pollution is well aligned with The Nature Conservancy's goal of restraining the deterioration of forest resource and conserving biodiversity in northwest Yunnan, China. TNC-China was one of eleven non-profit organizations awarded two-year grants by the U.S. Environmental Protection Agency in support of the PCIA to implement innovative, community-based programs to reduce indoor air pollution from household energy use.

Based on the four priority areas of the Partnership (Social/Behavioral Barriers, Local Market Development, Technology Design and Health Effects), under this PCIA project the TNC alternative energy team identified and demonstrated effective alternative energy systems, including improved fuel-efficient stove/ fireplace, solar water heater, and biogas digester with greenhouse in 6286 households in Lijiang, Shangri-La and Deqin County of NW Yunnan. In addition, 26,286 households in this region were educated about the health impacts of indoor air pollution and mitigation solutions. In collaboration with stove specialists from both home and abroad, the team developed some appropriate household stoves which can be produced locally and provided guidance for the design and performance of improved house cooking and heating technology for local communities, especially for the households in cold and high elevation areas. Meanwhile, alternative energy market development was carried out in this project under a grant from the TNC-established China Rural Energy Enterprise Development (CREED) project, creating a feasible path of sustainable energy development for the benefit of rural energy enterprises as well as poor rural communities. Results from two rounds of indoor air quality monitoring in winter and summer at Deqin and Yulong County show that alternative energy is effective to help reduce indoor CO concentrations by more than 50%, $PM_{2.5}$ by 71% and firewood consumption volume by 68% in both Naxi and Tibetan households.

Overall, the awareness of energy-savings and indoor air pollution has been raised among the target population through household/school demonstration and community outreach and education, and hence more and more people would like to choose the alternatives as a new device. However, widespread poverty results in low income levels, and despite subsidies for the installation of alternative energies from this project and from local government, many rural households still need credit or loans to purchase or begin using cleaner energy. Thus, an important means to create product accessibility in impoverished communities is close coordination with all concerned levels and divisions of local government. Income-generating activities are essential to allow local people to take the step of acquiring relatively costly apparatus for their energy needs.

Through this program, TNC-China noted multiple lessons learned, with recommendations for future actions: 1) Because of the higher elevation, stronger sunshine and lower temperature, solar energy should be developed as the dominant alternative energy in NW Yunnan, rather than biogas unit or others, in improving health energy infrastructure if integrated with a broader array of end uses. 2) A range of intervention technologies, from one as simple as adding a chimney to the more complex modernized alternative energy program, are available, but these technologies can be viable only with a coordinated support from the government and interested private parties in the commercial sector. Co-financing support from local government financing strategies of micro-credit loans and income generation (for example, the Green Village Credit Program, TNC China) are effective measures. 3) Commercial stove dissemination in rural areas should be integrated

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with other programs to increase sustainability, especially to develop a project of appropriate stove design and dissemination in frigid mountainous area of NW Yunnan, and 4) The central and local governments are important players and need to continue their efforts in many areas, including the development and enforcement of energy efficiency and environmental standards, protection of intellectual property of advanced technologies, public education regarding health hazards, training of technicians, and support for focused health and environmental studies.

Interview and training for villagers

To scale up the project and promote improved cooking and heating practices that are more efficient, meet users' needs, reduce exposure, and can be produced locally, we have participated in the project of Scaling-up of High-Efficiency Low-Emissions Biomass Household Stoves in Western China implemented by fellow PCIA Partner CAREI with the goal of helping to select some pilot sites for the CAREI project within the TNC project area. This kind of cooperation is expected to extend the influence and solidify the success of PCIA pilot project on a larger scale, and to scale up alternative energy installation and benefit more of the population in China.

For more information, please visit: http://www.nature.org/wherewework/asiapacific/china/strategies/art13329.html.

High Efficiency, Low Emissions Stoves Contribute to Household Energy Utilization

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Firewood, straw and coal are the most common fuels in rural China for cooking and heating. These fuels are usually burned in rudimentary stoves, causing emissions that seriously contaminate household indoor air quality when the kitchens are inappropriately managed.

In order to provide excellent stoves to the rural areas, biomass stove technologies are now being developed. The 20 stove producing companies in Beijing, Shandong and Henan provinces have the ability to produce more than 20,000 stoves per year, but are producing well below that number currently, due to distribution and demand challenges. More than 10,000 high efficiency low emissions semi-gasified biomass stoves are now being used in the above mentioned provinces as well as Sichuan province, with plans for 8,000 more now underway.

The Renewable Resources Laboratory at China Agricultural University (RRL) has done on-site stove performances testing of these stoves from 2002, including thermal efficiency and indoor air quality (IAQ) monitoring where the coal stoves, biogas stoves and the semi-gasified biomass stoves are used respectively in rural China. CO, SO_2, NH_3 and $PM_{2.5}$ are typical parameters monitored for IAQ.

The results in Sichuan province showed that the average efficiency of improved biomass stoves was 32%; traditional stoves have a mean efficiency of 18%, and open stoves have a 7% efficiency. With coal and traditional biomass stoves, IAQ monitoring showed that the pollution levels of CO, SO_2, NH_3 and $PM_{2.5}$ all exceed the China Indoor Air Quality Standard covering CO, SO_2, and NH_3 and the U.S. National Ambient Air Quality Standards NAAQS for $PM_{2.5}$. After the biogas stoves and semi-gasified biomass stoves were introduced, indoor air pollution levels in the 5 selected counties improved greatly in the homes that had adopted the new technologies. The average reductions in CO, SO_2, $PM_{2.5}$ and NH_3 in these homes were 74%, 88%, 44% and 57%, respectively.

The thermal efficiency of the improved semi-gasified biomass stoves in Beijing, Shandong and Henan reached 35%, a high efficiency which is

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Stove building

beneficial in saving time spent on collecting fuels and cooking, and in reducing fuel consumption.

The $PM_{2.5}$ emissions from semi-gasified stoves in Beijing, Shandong and Henan are 39.6%, 70.8%, 29.2% that of a coal stove., and the CO emissions from semi-gasified stoves in Beijing, Shandong and Henan are 23.2%, 10.9%, 4.1% that of coal stove. CO concentrations produced by the new stoves were under the Indoor Air Quality Standard of China.

Lower emissions are beneficial to the households, especially for women, children and elderly. Meeting the households' needs is the most important factor in promoting use of the new stoves. For instance, convenience is noted as the first requirement from the farmers; the newly designed stoves are equipped with a hot water heater which connects to the heating system for rural China, which can benefit farmers in winter.

The Partnership Helps Partners in Asia Strengthen Their Programs in Three Key Areas

Over the last four years, more than 200 Partners in Asia have participated in six PCIA regional workshops to learn new skills in social marketing, monitoring and evaluation, and stove design and performance. These workshops have resulted in innovative local promotional campaigns; more data available on the performance of cooking technologies and the socioeconomic impact of interventions; and an increased number of new improved technologies being promoted. Ultimately, the combined effects of these capacity building efforts will lead to improved health, family economics and quality of life; reduced poverty and impact on environment; and increased job opportunities throughout countries in Asia.

Social Marketing

PCIA's first workshops were held in India with Development Alternatives and Appropriate Rural Technology Institute in 2003. Approximately 90 participants developed local social marketing campaigns to increase the use of clean, efficient, affordable and safe home cooking practices. These workshops were sponsored by the Shell Foundation and U.S. Environmental Protection Agency (USEPA).

Monitoring and Evaluation

PCIA has held two monitoring and evaluation workshops in Asia. The first was sponsored by the World Health Organization under a cooperative agreement with the USEPA in Sri Lanka in February 2006. Thirty health officials and household energy experts from 10 Asian countries participated in the workshop. A limited number of hard copies of the workshop resources "*Indoor Air Pollution and Household Energy Monitoring*" are available, and can be requested by e-mail to PCIAonline@yahoo.com.

The second PCIA regional workshop "*Measuring Change: Indoor Air Pollution and Household Energy Monitoring*" sponsored by USEPA, ARECOP and Winrock International was held in Vietnam August 2007 with more than 40 participants from 10 countries. During interactive and hands-on sessions led by trainers from the Center for Entrepreneurship in International Health and Development (CEIHD), household energy and health experts learned how to select study design, calculate sample size, administer socioeconomic impact surveys, and collect and analyze carbon monoxide (CO) and particulate matter (PM) samples to assess the exposure, socioeconomic and environmental impact of their household energy interventions.

Local organizers from the Hanoi Architectural University arranged a field visit during which participants deployed carbon monoxide and particulate matter monitors in five rural kitchens for a 24-hour period. The data was collected and analyzed in subsequent sessions. One participated stated, "the field trip was very beneficial; it added a face to what we came to learn."

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In addition, three guest speakers presented case studies on various monitoring and evaluation initiatives in Asia. Mrs. Tran Thi Hong of the Vietnamese Women's Union informed the group about their improved cookstove program being implemented in 25 communes in 13 northern and central provinces of Vietnam resulting in 30,000 stoves. Dr. Priya Karve of the Appropriate Rural Technology Institute in India educated the group about their commercialization of improved biomass fuels and cooking devices, which resulted in created 120 enterprises that sold 75,000 improved devices by end of 2005, about 60% of which were fixed cement stoves. This work led to a scale up project aimed at creating 300-500 enterprises, and putting improved cooking devices in 1 million rural homes by end of 2010. The third case study was presented by Mr. Tom Owino of Pioneer Carbon, who shared examples of household energy projects receiving carbon financing. To view these presentations, along with the training modules and participant monitoring plans, visit http://www.pciaonline.org/Proceedings.

Stove Design and Performance workshop participants, trainers and sponsors

Stove Design and Performance

The most recent PCIA workshop was held in Indonesia, June 6-12, 2008. The workshop was cosponsored by ARECOP, USEPA and Winrock International, with technical trainers from Aprovecho Research Center. Twenty-one participants representing 11 organizations in seven countries learned how to conduct the water boiling test (WBT) and controlled cooking test (CCT) on their stoves; and how to apply design principles to improve their stoves. Participants will return to their countries to conduct lab WBTs and field CCTs on the primary stoves they are disseminating, and are committed to making design changes to their stoves to improve performance. Participants set a fuel use benchmark for wood burning stoves at 825 gm per WBT. "Meeting and sharing with many other people who design and promote improved cookstoves, and the process of setting the benchmark," were two beneficial outcomes of the workshop.

In August 2005, the USEPA, ARECOP, and Approtech Asia co-sponsored a regional PCIA Stove Design and Performance workshop in Iloilo, Philippines to increase the capacity of local organizations to design, evaluate and produce clean burning, efficient, safe and affordable cooking technologies. Expert trainers from Aprovecho Research Center and USEPA/Office of Research and Development presented classroom instruction, discussion and "hands-on" laboratory activities on such things as combustion and heat transfer theory, stove design principles, fuel preparation, insulative ceramics for combustion chambers, and stove performance testing. The twenty-two participants from the Philippines, Cambodia, Indonesia, Nepal, Sri Lanka and Vietnam tested, evaluated, and redesigned indigenous stoves for improved performance.

Conclusion

Participant feedback from these workshops indicated that participants appreciated the hands-on, participatory workshop format, and found the interaction and networking with other regional experts essential in identifying solutions and effective approaches for their individual stove programs. The Partnership for Clean Indoor Air will continue to provide Partners with regional training opportunities to strengthen vital components of their stove programs. Visit the PCIA website for information on upcoming regional workshops. If you would like to co-sponsor a regional workshop, please contact us at PCIAonline@yahoo.com.

☼ HAPPENINGS

Recent Partner Activity…

Expanding Access to Energy in Asia and the Pacific

From June 3-5, 2008, the Asian Development Bank (ADB) held the 2008 Asia Clean Energy Forum, jointly organized by ADB and USAID with other partners. ADB, together with other partners, also organized a pre-forum event on June 2, 2008 in Manila to discuss the problems and barriers, successful case studies, and ways to increase participation of private sector and financial institutions in the delivery of modern forms of energy for the poor.

Participants in the pre-forum event agreed that there are several successful models already available and the need is to scale up these initiatives. There are still about 1 billion people in Asia who do not have access to electricity and many more are still using biomass and inefficient cooking stoves to meet their cooking needs.

Partners proposed several approaches to scale up and one common suggestion was to start up a regional initiative for Asia and the Pacific where all partners can help each other to scale up the activities. There is a growing need for public-private partnership and greater participation of financial institutions, especially micro-finance institutions in providing access to modern forms of energy.

More than 80 participants representing governments, private sector, NGOs, financial institutions and other development partners took part in the pre-forum event. ADB is now developing new strategic approach to assist scale up access to energy projects for the poor in Asia and the Pacific region under its Energy for All Initiative. More information about this initiative can be found at: http://www.adb.org/Clean-Energy/energy-initiatives.asp.

More than 500 people participated in the main forum to discuss scaling up clean energy investments to address energy security and climate change. More information about these events, presentations and more can be found at: http://www.adb.org/Clean-Energy/highlights.asp.

Solar Cooker Program Held at Bilpudi, Dharampur District, Gujarat on December 17th, 2007

Eco-Center ICNEER (for International Center for Networking, Ecology, Education and Reintegration) is an NGO based in Gujarat, India. ICNEER is active in promoting sustainable development taking ecologic as well as economic and social aspects into consideration. It propagates the concept of natural living, natural farming and conservation of natural resources which leads not only to a cleaner environment, but also to a raise of the economic and social quality of life in rural and urban areas. As part of this work, the Eco-Center is actively demonstrating the use of various types of solar cookers, namely the Solar Box Cooker, CooKit, Hot Pot, SK14 Seifert Domestic Parabolic Solar Cooker and Scheffler Community Parabolic Solar Cooker. Recently, Dr/Mrs. Shirin Gadhia, President of Eco-Center ICNEER along with Ida Poinstingl, a student from Austria, have been demonstrating solar baking with the SK 14 Seifert Domestic Parabolic Solar Cooker.

The cooker is an ideal income-generation tool and can be made available through micro-financing. Such funds as the generous donation of Austrian schoolchildren of the cities of Salzburg and St. Johann, made available through the NGOs INTERSOL and PLAGE, are helping Eco-Center ICNEER to provide donations and subsidies for solar cookers to its partners. Creating awareness and widespread acceptance are the major goals of the Eco Center's activities in this field.

On 17th of December 2007, Eco-Center held a solar baking program at the Canossian Sisters Center at Bilpudi, Dharampur District, Gujarat for tribal women from surrounding villages. The Canossian Sister's Hostel provides medical care, a mobile clinic and social workers for the area. The founder of the Canossian Sisters Organization is Magdalene of Canossa in Italy. There are five sisters based in the Bilpudi hostel who cooperate closely with health workers in the villages who act as intermediaries, distributing medicine given by the sisters at minimal rates. They also give out information about current activities and programmes.

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On that day 40 women from surrounding villages of Fulwadi and Bilpudi had come to participate in the program. The main purpose of the program was to show the women how they could use the solar cooker for income generation. Earlier they had participated in a program at Eco-Center in which they had cooked their traditional dishes on the Scheffler Community Cooker.

Bread, Sweet Pav, Chocolate Cookies and Butter Cake were also baked on the solar cooker and the women were very impressed with its performance. In order to show the women not only the economic advantages of the solar cooker, posters were developed and presented explaining the ecological value of solar cooking as well as information on water conservation and organic farming.

Women's group and Dr. Mrs. Shirin Gadhia (right) with solar baked bread & SK14 Parabolic Solar Cooker

In general, Eco-Center ICNEER's solar cooker activities prove to be a successful means of spreading solar cooker technology in India's villages. The Smoke Free Village Bysanivaripalle in Andhra Pradesh is a shining example for its bearing fruits. The entire village is cooking with 26 SK14 solar cookers and 23 biogas plants provided through micro financing and in collaboration with NEDCAP (Non-Conventional Energy Development Corporation of Andhra Pradesh) , INTERSOL and ICNEER. Additionally, the villagers are using the cookers to bake cakes and sell them on the nearby market.

Nevertheless, it has to be stated that the implementation of solar cookers is not always easy. A lot of awareness training is needed before people will to decide to use the cookers and change their usual habits, especially if fuel wood or other polluting energy resources are easily and cheaply available. For more information on the many activities of Eco-Center ICNEER, please visit icneer.gadhiasolarenergy.com.

KOSIE Asian Forum

The Korean Society for Indoor Environment (KOSIE) held its first Asian Forum on indoor air successfully on 13-14 September, 2007 at Hanyang University, Seoul, Korea. Seven keynote speakers from 6 Asian countries (Taiwan, Japan, China, Singapore, HongKong, Thailand) and Denmark presented their countries' current R&D and Policy in Indoor Air Environments and about 200 papers were presented.

Upcoming Events...

ETHOS Stove Camp 2008
August 4-8, 2008, Cottage Grove, Oregon

Stove Camp this year will take place at the new Aprovecho lab on 4 beautiful acres with a nice river on two sides of the property. We will cook on wood burning stoves for lunch and dinner and bake tasty bread in a Rocket bread oven. We can have bonfires at night and figure out how to distribute one billion stoves.
For more information please visit the PCIA Calendar at http://www.pciaonline.org/pciacalendar or contact Dean Still at dstill@epud.net or 541-767-0287.

2008 International Training Workshop on Technology and Utilization of Biomass Gasification
September 1-20, 2008, Yingkou, China

2008 International Training Workshop on Technology and Utilization of Biomass Gasification This workshop is part of a series of annual international technical training workshop and courses conducted as a part of China's Ministry of Science and Technology's international scientific and technical cooperation programs. For more information please visit: http://gasifiers.bioenergylists.org/yinkougasworkshop08.

Fourth International Conference on Biomass for Energy
September 22-24, 2008, Kyiv, Ukraine

The purpose of this conference is to encourage

(Continued on page 21)

(Continued from page 20)
the use of biomass for energy production and promote sustainable development of bioenergy technologies in Ukraine. For more information please visit: http://www.biomass.kiev.ua/conf2008/index.php?lang=en.

Sustainable International Biofuel Summit & Expo 2008
October 22-24, 2008, Buenos Aires, Argentina

For information please visit http://www.biofuelsummit.info/en/conferences/buenosaires/.

21st World LP Gas Forum
September 24-26, 2008, Seoul, Korea

The World LP Gas Forum draws international agencies, policy makers, and industry leaders to explore the future of the LP Gas industry, discuss its growth potential, and forge new business relationships. The theme of this year's event is "LP Gas - clean energy for a low carbon world". For more information about the forum please see http://www.wlpgasforum2008.com/welcome_remarks.html.

International Women Environmental Entrepreneurs Fair
October 5-14, 2008, Barcelona, Spain

This Entrepreneurs Fair will be held in conjunction with IUCN World Conservation Congress. The Fair aims to facilitate and strengthen women's enterprises that produce environmentally friendly products or services, and showcase women's business activities that go beyond regional borders and contribute to environmental conservation and the alleviation of poverty. For more information see http://www.genderandenvironment.org/noticias/noticia.php?id=63.

3rd International Conference on Renewable Energy Technology
October 12-14, 2008, Kathmandu, Nepal

Following the successful 1st International conference (RETRUD-98) and 2nd International conference (RETRUD-03), the 3rd International Conference on Renewable Energy Technology for Rural Development (RETRUD-08) is expected to provide a forum for exchanging information and ideas, presenting new developments in various renewable energy technologies, and provide networking opportunities for global partnership for the betterment of rural people. For more information please see the conference website: http://retrud.ioe.edu.np/.

ISEE/ISEA Joint Annual Conference
October 12-16, 2008, Pasadena, California

The International Society for Environmental Epidemiology (ISEE) and International Society of Exposure Analysis (ISEA) Joint Annual Conference is an opportunity for participants from around the world to exchange ideas about exposure, health, and epidemiology. For more information please see the conference website: http://secure.awma.org/events/isee-isea/index.htm.

Latin American Carbon Forum
October 28-30, 2008, Santiago, Chile

Information on this event will be available in the coming months at: http://www.latincarbon.com/2008/english/index.htm.

Better Air Quality (BAQ) 2008
November 12-14, 2008, Bangkok, Thailand

The theme of BAQ 2008 will be “Air Quality and Climate Change: Scaling up win-win solutions in Asia”. For more information please see http://cleanairnet.org/caiasia/1412/article-72204.html.

Research Conference on Alternative Cooking Fuels
December 11-12, 2008, New Delhi, India

The Women’s Commission for Refugee Women and Children is pleased to announce this international research conference on firewood and alternative cooking fuels. The conference will bring together developers, practitioners, users of alternative fuels and energy technologies and protection strategies appropriate for use in humanitarian settings from all over the world with the aim of sharing experiences and creating new linkages and networking technologies, as well as building an empirical basis for fuel-related interventions in humanitarian settings. A limited number of sponsorship opportunities will be available for field-based practitioners. For more information, including for an event flyer, please visit the PCIA Calendar at http://www.pciaonline.org/pciacalendar.

☼ WHAT'S NEW?

In Research...

BMC Int Health Hum Rights. 2008 Jun 5;8 (1):7 **Self-rated health among Mayan women participating in a randomised intervention trial reducing indoor air pollution in Guatemala.**
Diaz E, Bruce N, Pope D, Diaz A, Smith KR, Smith-Sivertsen T.
This study was conducted in rural highland Guatemala, involving 89 intervention and 80 control Mayan Indian young women (mean 27.8 years, SD 7.2). Outcomes were assessed after approximately 18 months use of the new stove. On intention-to-treat analysis, 52.8% of intervention women reported improvement in health, compared to 23.8% of control women ($p<0.001$). Among 84 intervention women who reported reduced kitchen smoke as an important change, 88% linked this to improvement in their own health, particularly for non-respiratory symptoms (for example eye discomfort, headache); 57% linked reduced smoke to improvement in their children's health, particularly sore eyes. Conclusions: Women's perception of their health was improved, but although smoke reduction was valued, this was linked mainly with alleviation of non-respiratory symptoms like eye discomfort and headache.

Indoor Air. 2008 Apr;18(2):93-105. **Reduction in personal exposures to particulate matter and carbon monoxide as a result of the installation of a Patsari improved cook stove in Michoacan Mexico.**
Cynthia AA, Edwards RD, Johnson M, Zuk M, Rojas L, Jimenez RD, Riojas-Rodriguez H, Masera O. Center of Ecosystems Research, Bioenergy, National Autonomous University of Mexico, Mexico.
The impact of the Patsari improved wood burning stove in reducing personal exposures and indoor concentrations of particulate matter ($PM_{2.5}$) and carbon monoxide (CO) was evaluated in 60 homes in a rural community of Michoacan, Mexico. Installation of an improved Patsari stove in these homes resulted in 74% reduction in median 48-h $PM_{2.5}$ concentrations in kitchens and 35% reduction in median 24-h $PM_{2.5}$ personal exposures. Corresponding reductions in CO were 77% and 78% for median 48-h kitchen concentrations and median 24-h personal exposures, respectively. Conclusions: Installation of improved cookstoves may result in significant reductions in indoor concentrations of carbon monoxide and fine particulate matter $PM_{2.5}$, with concurrent but lower reductions in personal exposures. Significant errors may result if reductions in kitchen concentrations are used as a proxy for personal exposure reductions when evaluating stove interventions.

PCIA Website Update

Please visit the website (www.PCIAonline.org) for information on PCIA activities!

Recent updates to the website include:

- **New Articles in Media Coverage**
- **Information on New Partners**

We encourage you to visit the website and give us feedback on these new features. For any website related questions please contact Winrock International at PCIAmoderator@yahoo.com.

Have you checked out the Environmental Health Project website recently? More information on the following studies is available at http://www.ehproject.org/ehkm/iap-feature.html.

- Effects of Cooking Fuels on Acute Respiratory Infections in Children in Tanzania
- Comparison of Particulate Matter from Biomass-Burning Rural and Non-Biomass Burning Urban Households in Northeastern China
- Prenatal Exposure to Wood Fuel Smoke and Low Birth Weight

Your comments are welcome!

This newsletter is published by Winrock International on behalf of the Partnership for Clean Indoor Air. To share comments, suggestions, news, and article contributions please email PCIAonline@yahoo.com. The deadline for contributions to next quarter's Bulletin, the topic of which is Partner progress since the 2007 PCIA Forum, is **August 15th, 2008**.

DISCLAIMER: Unless otherwise stated, information contained in this Bulletin is not necessarily the opinion of and/or endorsed by all Partners.

☼ FACT BOX

PCIA Partners in Asia

65 Organizations in 16 Countries

reducing exposure to indoor air pollution

•Aga Khan Planning and Building Service, Pakistan
•Alternative Energy Promotion Centre/Energy Sector Assistance Programme (AEPC/ESAP)
•Appropriate Rural Technology Institute (ARTI)
•Asho Jati Gore (AJAG)
•Asia Regional Cookstove Program (ARECOP)
•Barendra Advancement Integrated Committee (BAIC)
•Cambodia Fuelwood Saving Project
•Central Philippine University-Approtech Center
•Centre for Energy and Environment Technology and Management
•Centre for Renewable Energy and Appropriate Technologies (CREAT)
•Centre for Rural Enlightenment, Salvation for Health & Environment (CRESHE)
•Centre for Rural Technology, Nepal
•China Agricultural University's Renewable Resources Lab
•China Association of Rural Energy Industry (CAREI)
•Chinese Ministry of Agriculture, Division of Energy, Ecology and Environment, Center for Science and Technology Development
•Clean Air Initiative for Asian Cities (CAI-Asia) Center, Inc.
•Concern Worldwide, Bangladesh
•Development Alternatives
•Development Concern
•Eco Center ICNEER (International Center for Networking, Ecology, Education and Re-integration)
•Energy Management Centre - Kerala
•Energy Research Centre
•Energy Systems
•Environment and Public Health Organization (ENPHO)
•Foundation for Communication Initiatives
•Gadhia Solar Energy Systems Pvt. Ltd.
•Geoecology Energy Organization (GEO)
•GERES Cambodia
•GREAN Studio Nepal
•Heta Datain
•Institute for Environmental Health and Related Product Safety (IEHS)
•Integrated Research and Action for Development (IRADe)
•Interface Foundation
•International Energy Initiative (IEI)
•JID Equipment Engineering
•Khadagdhari Gramin Vikas Sansthan
•Kingdom of Cambodia
•Korean Society for Indoor Environment (KOSIE)
•Local Government Engineering Department (LGED)
•Nature Conservation Management (NACOM)
•Nishant Bioenergy
•Peking University Health Science Center
•Practical Action Bangladesh
•Practical Action in Nepal
•Prakti Design Lab
•Rural Energy Development Programme
•Rural Mutual Development
•Rural Region and Agro-forestry Development Centre (RRAFDC)
•SHARAN
•Shri Jagdamba Samiti
•SKG SANGHA
•Strengthening Rights and Equality by Empowering Teams (STREET)
•Sustainable Technology Adaptive Research and Implementation Center (STARIC/N)
•Technology Informatics Design Endeavour (TIDE)
•Tezpur University
•The Asian Alliance of Appropriate Technology Practitioners, Inc. (Approtech Asia)
•The Energy and Resources Institute (TERI)
•The Nature Conservancy China Program
•Vietnam Clean Air Partnership (VCAP)
•Village Education Resource Center (VERC)
•West Negros College - Improved Cook Stove Center
•Winrock International Nepal
•Women for Sustainable Development
•Yayasan Dian Desa-Indonesia Cookstoves Network (JKTI)

•Bangladesh•Cambodia•China•India•Indonesia•
•Korea•Maldives•Sri Lanka•Myanmar•Nepal•Kiribati•
•Pakistan•Philippines•Thailand•Touvalu•Vietnam•

PCIA Events